Investment behavior of egg producers: analyzing the impacts production risk and production costs variability

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Specialty eggs now account for roughly 16% of egg consumption and are a fast growing market. From a supply management point of view, an egg is an egg. Therefore, premiums to cover cost of production differential are up to individual negotiations between buyers and farmers. In accordance with industry practices, we define specialty eggs as Omega 3, organic, free run and free range. Consequently, egg producers are facing the decision of whether or not to produce several types of eggs that each may have different levels of risk and uncertainty. Several studies have shown that this risk level varies by type of eggs. The empirical question that emerges is how do these risks affect producers' optimal decisions?

Production risk depends on the type of eggs …

Patterson et al. (2001) compare two systems of egg production: specialty eggs (alternative systems) and conventional eggs (conventional cages). They find that the technical performance of alternative production systems is inferior to that of conventional cages.

Table 1. Characteristics of the measure of egg production in alternative production systems versus conventional cage systems

Elements	Alternative systems	Conventional cages
Mortality rate	7.2%	5.2%
Feed per egg produced	162 g	142 g
Eggs rejected by hen	8.5%	6.3%
Number of eggs per hen and per year	259	284

Source: Patterson et al (2001)

De Reu et al. (2008) also report that contamination of egg shells by aerobic bacteria (Salmonella enteritidis (Se)) is generally higher for eggs in cage-free systems (free-range farming) compared with eggs in conventional cages. This can incur additional costs associated with decontamination and reduced marketed production.

… as is the variability of production cost

In cage-free systems, laying hens have more space than in conventional cages and spend more energy. The extra energy expense of free-range hens reduces food efficiency; therefore the relative share of feed in the production cost is greater, which is translated *de facto* by higher transmission of price variability of primary agricultural goods to costs. The main production inputs whose price variability is transmitted to costs are hen feed, labor and energy (Summer et al., 2010).

Table 2. Comparison of the contribution in % of different items to production costs between cage and non-cage production systems

Items	Cage production system	Non-cage production system
Chicks	13.42%	14.76%
Food	48.99%	40.48%
Housing	12.75%	21.90%
Labor	4.70%	12.38%
Additional costs	20.13%	10.48%
Total costs	100.00%	100.00%

Source: Calculations based on Sumner et al (2010)

Soya and corn grains represent the main cereals used in the diet of hens. In 2005 the mean of monthly prices of corn was 108.62 $/ton and reached 255.73 $/ton in 2011 with coefficient of variation of 15% in 2005 and 344% in 2011. For soya the means of monthly prices were 410.85 $/ton and 479.79 $/ton for 2005 and 2011 respectively. For soya the coefficient of variation reached 274% in 2008 and was at 50% in 2005.[i] The higher variability in grain prices was therefore transmitted to production costs but to different degrees given that, depending on the type of production, grains made up different proportions of the feeds. Therefore production cost variance caused by variability in inputs (i.e. grain) cost vary across specialty egg production systems.

To summarize, the risk captured by variance of production costs differs depending on the type of egg. Therefore, it is of interest to include risk in an empirical analysis of producers' optimal choices of egg production methods.

Methodological approach

Attempts by researchers to integrate risk and uncertainty in mathematical programming models have led to the expected-mean-variance model in quadratic programming. In this type of model, risk and uncertainty are considered by a variance-covariance matrix. The optimal production plan is selected based on the expected gross margin and its variance (Chavas, 2004). Accordingly, we seek an optimal plan for a farm producing several types of eggs. The producer's objective is to maximize its expected gross margin. Given the available data, we restrict our analysis to production of conventional, Omega 3 and free-range eggs.

The data used for the analyses cover the period ranging from January 2009 to December 2011. We use the data published by the CRAAQ (2007) on average size of egg farms in Quebec.

Given an increase in variance of cost of production it becomes more profitable to increase production of Omega-3 eggs

Figure 1 presents the effects of an increase in variance of cost of production for the three types of eggs while keeping other factors constant.

Production of Omega-3 eggs appears to be the most sensitive to variations in the risk aversion coefficient, to reduction in egg prices and to the increase in price variance. Nevertheless, in an environment of high production cost variance, this type of eggs would fare better than conventional eggs because of its higher gross margin, but not as well as free range eggs.

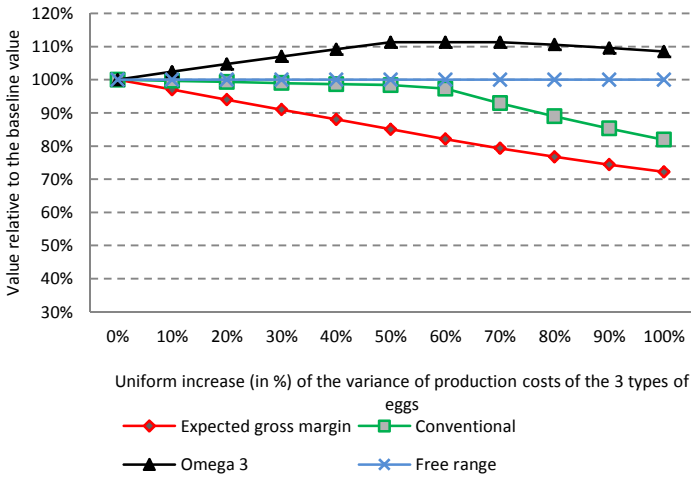

Figure 1. Effects of a uniform increase in variance of production costs on margin and quantity for three types of eggs under a constant relative risk aversion coefficient of 2.5

Concluding remarks

This study adds to our understanding of the role of risk and uncertainty in the investment decision of egg producers and different mode of production, as well as in the development of the growing production of specialty eggs in Canada. It also fills a gap in the literature regarding the impact of risk in Canadian egg production. This gap is likely explained by the perception of a lack of risk in this supply managed sector in Canada and its small size relative to other supply managed sector. Interestingly, from our general results we can deduct that supply management, by reducing the perceived risk level, favored the development of specialty eggs in Canada.

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[i] See Statistics Canada. Table 02-0043 – Farm product prices, crops and livestock.